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EXPERIMENTS IN PREVENTING THE BUILD-UP OF INSECTS IN NEWLY HARVESTED WHEAT

By Gailen D. White
Division of Stored Product Insect Investigations

An effective method of preventing the build-up of insects in newly harvested wheat has long been needed. Normally wheat is not infested in the field, but after it is harvested insects may begin an infestation by moving into the wheat from hiding places in the storage bin such as cracks or tunnels, or from waste grain, feed rooms, and other nearby sources. It has been observed that stored-grain insects can multiply themselves more than 40 times in farm-stored wheat during the first 4 months of storage in wooden farm granaries.

After the wheat is harvested, the insects have from 3 to 6 months in which they can multiply rapidly before winter temperatures cool the wheat. A means to prevent the increase of insects in the grain during the post-harvest period is therefore highly desirable.

Dusts have been employed for the protection of seed for many years, but the materials used are not suitable for grain intended for feed or food, because of their toxic nature. Recently dusts containing pyrethrum and similar materials have been considered, since they would not be harmful to animals or humans in the amounts used. It is not feasible to add inorganic diluents to commercial stocks of grain, since they tend to lower the grade, being indistinguishable from lime or other foreign matter causing down-grading. It has also been found that insecticidal sprays applied to the walls and floors of wooden storage bins before being filled are very helpful in reducing initial infestation from these sources.

Therefore, in the summer of 1951 tests were made in farm bins in Reno County, Kans., to determine the effectiveness of (1) insecticidal sprays applied to interior walls of wooden farm granaries, (2) fumigants applied late in August, and (3) synergized-pyrethrum dusts in preventing population build-up in newly harvested wheat. Where bins were sprayed, a water emulsion containing 0.2 percent of pyrethrins and 2 percent of piperonyl butoxide was applied at the rate of 1 gallon per 1,000 square feet of wall area, or a 2.5-percent water suspension of DDT applied at the rate of 2 gallons per 1,000 square feet. The bins in the fumigation

series were fumigated with a 3:1 mixture of ethylene dichloride and carbon tetrachloride, applied at the rate of 6 gallons per 1,000 bushels of wheat. The protectant dust contained 0.08 percent of pyrethrins and 1.1 percent of piperonyl butoxide[1/] in a wheat-dust diluent. It was applied at the rate of 75 pounds per 1,000 bushels.

The tests were grouped into six series as follows:

1. Control, no treatment (19 bins).
2. Fumigation late in August (12 bins).
3. DDT spray on walls (9 bins)
4. Pyrethrum-piperonyl butoxide spray on walls (8 bins).
5. Pyrethrum-piperonyl butoxide dust in wheat (9 bins).
6. Pyrethrum-piperonyl butoxide spray on walls, pyrethrum-piperonyl butoxide dust in wheat (7 bins).

In series 5 the wheat was treated with a special applicator attached to a portable auger-type elevator, by which the rate of dust flow was regulated.

In series 6 the dust was applied to the wheat by the individual farmers as the bins were filled with whatever equipment they had at hand. Some of these bins were filled by auger-type grain elevators, and the dust was introduced as the grain was dumped from the truck to the auger so that the mixing of dust with grain was done by the auger. In other bins the dust was added to the grain stream as it was dumped from the truck into the pit of a stationary bucket-type farm grain elevator. After the bins were filled with the treated grain, the grain surfaces were "capped" to a depth of 3 inches with the dust applied at twice the experimental rate, or 150 pounds per 1,000 bushels.

The original moisture content was determined for each bin. Once a month each bin was sampled at three locations with a 5-foot grain trier, or probe. The total number of insects present regardless of species was recorded for each sample. For series 1 to 5 observations were terminated in September, since the grain was either sold or used for seeding purposes. It was possible to take October records for series 6. Control bins were sampled to indicate the normal increase in insect population over this period. The September population levels were used as the measure of effectiveness of the various treatments, since insect populations in farm-stored grain in Kansas have usually reached their peak by that time.

1/ This material was furnished by U. S. Industrial Chemicals Co., Baltimore, Md.

The average original moisture content and the average number of insects per 1,000 grams of wheat for each series of bins are given in table 1. The bins in the control series developed the greatest population, i.e., 41.4 insects per 1,000 grams. The populations in all the treated bins were significantly lower than in the control series at the 1 percent level of significance.

The bins fumigated late in August had the lowest population in September. Those treated with dust gave the next best results. Insect populations were not significantly lower in dusted wheat in sprayed bins than in those receiving dust only. The October sampling in series 6 showed an increase in population, but this increase was entirely in one bin in the series. The bin receiving DDT wall spray averaged considerably lower in insect population than the one sprayed with the pyrethrum-piperonyl butoxide mixture.

Samples of dust-treated wheat from bins in series 5 and 6 were submitted to the Kansas State Grain Inspection Department for grading. No change in grade resulted from the use of this dust.

Table 1.--Average moisture content and numbers of insects found in wheat stored in wooden farm bins in experimental series, Reno, County, Kans., 1951

Series	Treatment	Percent moisture	Number of insects per 1,000 grams of wheat in--			
			July	August	September	October
1	None (controls)	13.0	4.6	14.5	41.4	-
2	Fumigation in August	12.0	0	2.7[1/]	0.5	-
3	DDT spray on walls	12.9	0.1	2.2	6.1	-
4	Synergized pyrethrum spray on walls	12.2	.1	12.1	16.4	-
5	Synergized pyrethrum dust in wheat	12.3	0	0.3	2.6	-
6	Synergized pyrethrum spray on walls; synergized pyrethrum dust in wheat	11.6	0	.1	2.4	4.0

1/ Before fumigation.

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